Original Research

A large regional hospital's experience with treatment of end-stage renal disease

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During the first 10 years of the treatment program for end-stage renal disease at the Saint John (New Brunswick) Regional Hospital 164 adults were treated by hemodialysis (with or without renal transplantation, performed outside of the province) or peritoneal dialysis. The primary causes of renal disease were not significantly different in men and women except for glomerulonephritis, which was twice as common in men as in women. Life-table analysis showed that the younger transplant recipients had the highest survival rate, but that the prognosis was almost as good among the much older patients who received continuous ambulatory peritoneal dialysis. Probably because they tended to be younger and their renal disease was caused by less threatening conditions, men survived longer than women. The survival rates were significantly related to the primary cause of the renal disease; patients with diabetes or systemic disease had the worst prognosis. Overall, these results compare well with those obtained in major university centres.

Durant les 10 premières années du programme thérapeutique mis sur pied à l'hôpital régional de Saint-John (Nouveau-Brunswick) pour les cas d'insuffisance rénale terminale 164 adultes ont été traités par hémodialyse (avec ou sans greffe rénale, pratiquée à l'extérieur de la province) ou par dialyse péritonéale. Les causes primaires d'insuffisance rénale ne différaient pas significativement entre les hommes et les femmes, sauf pour la glomérulonéphrite, qui était deux fois plus fréquente chez les hommes que chez les femmes. Une analyse par la méthode des tables actuarielles a montré que les plus jeunes receveurs de greffe avaient le taux de survie le plus élevé, mais que le pronostic était presqu'aussi favorable pour les patients beaucoup plus âgés qui étaient sous dialyse péritonéale ambulatoire continue. Probablement parce que les hommes avaient tendance à être plus jeunes et que leur insuffisance rénale était causée par des maladies moins graves, leur survie était plus longue que celle des femmes. Les taux de survie étaient significativement reliés à la cause primaire de la maladie rénale, le diabète et les maladies intéressant l'organisme entier offrant les pronostics les plus sombres. Dans l'ensemble, ces résultats se comparent bien à ceux qui sont obtenus dans les principaux centres universitaires.

In the last 20 years the treatment of end-stage renal disease has been developing steadily. Renal transplantation is still the ultimate therapy, but, depending on their requirements, patients can be treated by either peritoneal dialysis or hemodialysis, often in their homes. Peritoneal dialysis has been refined by the shift from intermittent to continuous ambulatory peritoneal dialysis (CAPD) and is now suitable for more than 30% of the patients.[1]

There are two reports from Canadian investigators describing the probability of long-term survival for patients receiving the different treatments, but both of them recount only the experience of major university medical centres.[2,3] Since more and more treatment programs for end-stage renal disease are being set up in regional hospitals, it is also important to document the survival rates associated with these programs.

We think our program in Saint John, NB, is typical of those operating in regional hospitals. It was started in June 1971 with the establishment of peritoneal dialysis and hemodialysis units. Patients also receive pretransplantation evaluation and post-transplantation follow-up; however, the renal transplantations are performed outside the province. This report describes the survival of patients with end-stage renal disease over a 10-year period with reference to the type of treatment received.

Patients and methods

From June 1971 through May 1981, 164 patients with end-stage renal disease were admitted to our dialysis/transplantation program at Saint John Regional Hospital. Twelve had joined the program after 3 or 4 months of dialysis elsewhere, and 11 had started receiving dialysis in our program but moved away, continuing their treatment in another medical centre. We were able to collect all the relevant data for these patients and included them in the analysis.

Each patient was evaluated by the renal service to

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determine the underlying cause of the renal disease, the degree to which renal function was impaired and whether there were any associated systemic conditions. Renal function was assessed either by measurement of endogenous creatinine clearance, corrected to 1.73 m^2 of body surface or by means of the calculations proposed by Cockcroft and Gault.[4] Before we had considered the patients to be in a state of terminal renal failure they all had undergone appropriate radiologic, laboratory and other relevant investigations.

The majority of the patients began to receive dialysis before any serious complications of renal failure became apparent. All were encouraged to undergo dialysis in their homes. When appropriate, we took steps to initiate a transplant work-up. We undertook regular follow-up assessments of the patients and provided relief for the families when needed.

Before 1978 we did not consider hemodialysis to be suitable for patients over the age of 65 years and encouraged them to accept intermittent peritoneal dialysis. Since then the type of dialysis has no longer been chosen on the basis of age. Also, CAPD was introduced in 1978. Transplantation has not been recommended, however, for patients over the age of 60.

For this study we reviewed the patient charts and applied standard criteria to categorize the primary causes of renal disease. We excluded any children younger than 16 years of age, who had been referred to a dialysis unit outside of New Brunswick, patients with disseminated carcinoma, global neurologic disorders or severe cardiopulmonary dysfunction, and patients with acute renal failure who were treated with dialysis for less than 1 month. The characteristics of the 164 patients included in the study appear in Table I.

In the statistical analysis of our data we assessed the influence of age, sex and primary cause of disease on the choice of treatment by means of a logistic regression model.[5] The survival curves were plotted by actuarial methods. The analysis of survival was performed with procedures of the Statistical Package for the Social Sciences, version 8.0.[6]

Table I—Primary causes of end-stage renal disease in 164 patients

Primary cause; no. (and %)	Men		Women	
	No.	Mean age (and extremes), yr	No.	Mean age (and extremes), yr
Interstitial renal disease;* 68 (42)	36	47.4 (20–74)	32	54.8 (18–80)
Glomerulonephritis; 50 (31)	39	44.3 (21–76)	11	38.8 (17–65)
Polycystic or hereditary renal disease; 19 (12)	12	51.3 (18–70)	7	49.7 (39–62)
Diabetes mellitus; 15 (9)	5	42.0 (23–72)	10	48.6 (27–65)
Systemic disorders; 12 (7)	7	52.1 (24–73)	5	43.2 (27–67)
Total	99	46.7 (18–76)	65	49.7 (17–80)

*The patients had nephrosclerosis (21), analgesic nephropathy (11), pyelonephritis or reflux/obstructive uropathy (21), stone diathesis or renal damage of nonspecific origin (15).

Results

Tables II and III illustrate the relations between age, the primary cause of disease and the type of treatment received. Preliminary analysis showed that the allocation to a particular treatment was not independent of age and primary cause ($p < 0.001$ by chi-square testing). We then analysed the relations between the form of treatment and primary cause, age and sex by a multivariate logistic model and found that all three variables were significantly involved in explaining which form of treatment a patient received. By ranking the normalized coefficients of the logistic model we found that the order of importance of the variables was age, sex and primary cause. These interrelations have to be kept in mind when interpreting the survival data.

The survival rates of patients receiving each mode of treatment are presented in Fig. 1. We found no significant differences in survival rates either between CAPD and hemodialysis alone or between CAPD and hemodialysis coupled with transplantation. All other pairs of survival rates were significantly different ($p < 0.005$).[7]

We also investigated how age alone had affected the patients' survival. Those who were less than 30 years of age had a significantly better survival curve: 77% of them lived more than 10 years, whereas only 50% of the older patients lived more than 25 months ($p < 0.001$).

Table II—Type of treatment received by each age group

Age (yr)	Treatment;* no. of patients			
	Hemodialysis†	Hemodialysis and transplantation‡	IPD	CAPD
16–20	3	4	0	0
21–30	9	19	0	0
31–40	11	8	3	1
41–50	11	6	3	1
51–60	28	8	2	1
> 60	18	0	15	13
Total	80	45	23	16

*IPD = intermittent peritoneal dialysis; CAPD = continuous ambulatory peritoneal dialysis.
†Includes five patients who received CAPD for less than 20% of their treatment time.
‡The grafts were obtained from 18 living and 27 nonliving donors. Three patients received a second graft from a nonliving donor.

Table III—Type of treatment received, by primary cause of disease

Primary cause	Treatment; no. of patients			
	Hemodialysis	Hemodialysis and transplantation	IPD	CAPD
Interstitial renal disease	38	11	10	9
Glomerulonephritis	21	25	2	2
Polycystic or hereditary renal disease	12	5	1	1
Diabetes mellitus	4	3	7	1
Systemic disorders	5	1	3	3
Total	80	45	23	16

Of the 35 patients less than 30 years old, 12 continued to receive hemodialysis throughout the study period and had a survival rate almost as good as that of the transplant recipients. The type of renal disease did not have any bearing on the prognosis in these younger groups. Among patients more than 30 years old, however, the relation between survival and primary renal disease was striking indeed. The groups with diabetes or systemic renal disease had the worst prognosis (Fig. 2). The survival rate after 3 years of treatment for the patients with polycystic or hereditary renal disease, glomerulonephritis or interstitial renal disease ranged from 46% to 57%; for patients with either diabetes or systemic disease it was only 15% to 20%.

The mortality was consistently higher in women than in men throughout the observation period (Fig. 3). The two sexes were about equally represented in most disease groups, but there were higher proportions of women with either diabetes or interstitial renal disease, and of men with glomerulonephritis.

Of the 80 patients receiving hemodialysis, the 46 who were treated at home had an excellent survival rate, with 50% still alive after 4 years. The survival curve of the 34 hemodialysis patients treated at the centre was strongly affected by the high mortality (30%) during the first 6 months; another 20% died during the next 6 months.

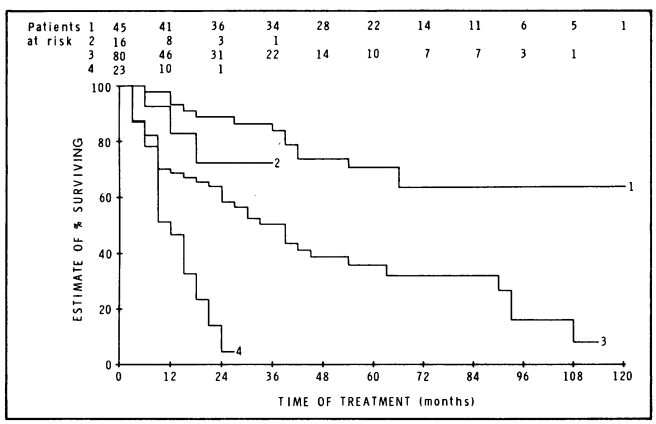

FIG. 1—Life-table estimates of survival according to form of treatment: 1, hemodialysis followed by transplantation; 2, continuous ambulatory peritoneal dialysis; 3, hemodialysis; and 4, intermittent peritoneal dialysis.

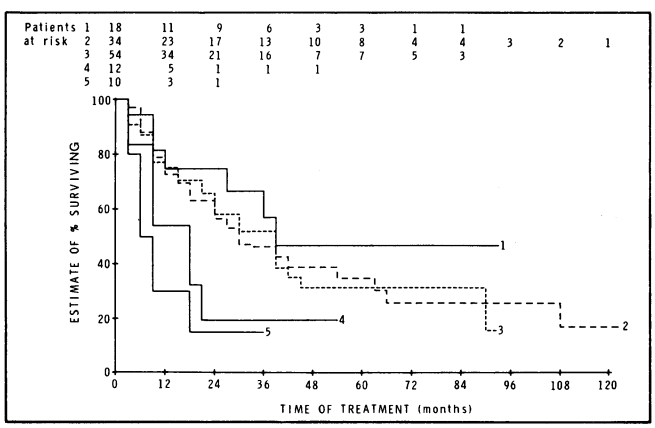

FIG. 2—Life-table estimates of survival according to primary cause of renal disease among patients older than 30 years: 1, polycystic or hereditary renal disease; 2, glomerulonephritis; 3, interstitial renal disease; 4, diabetes; and 5, systemic renal disease.

Discussion

Since our study was a retrospective analysis, one has to be careful with interpretation of the results. There was a definite bias in our allocation of treatment. Therefore, the observed influence of age on survival time may be a direct effect or may be the indirect result of the effect of age on the treatment choice. We had too few patients in some of the subcategories to determine the relative importance of age and treatment in survival. The significantly better survival rate for the patients under 30 years of age may, therefore, be explained by the fact that most of them received a renal transplant, whereas more than 60% of the patients over the age of 60 years received either intermittent or continuous ambulatory peritoneal dialysis. The overall experience with intermittent peritoneal dialysis at both Edmonton[2] and Vancouver[3] was very discouraging, and in our series more than 90% of the patients treated with intermittent peritoneal dialysis died within 2 years. When we introduced CAPD in 1978 the situation for older patients improved considerably, with the survival rate of patients so treated being almost as good as that of young transplant recipients.

The greater mortality for women than men probably reflects the larger proportion of women with interstitial renal disease. Among the patients with this condition the survival rate was lower for women, although the difference between males and females did not quite reach statistical significance. Also, a number of the women with interstitial renal disease were older than their male counterparts. Therefore, the combination of more advanced age and this type of primary renal disease may be the reason for the overall lower survival rate of the women. The greater proportion of women with diabetes, however, probably did not influence the women's mortality since the number with diabetes was small.

Besides looking at age, sex and the type of treatment, all of which are known to affect survival in cases of end-stage renal disease, we also attempted to detect any associations between survival and the primary cause of the renal disease. The groups with diabetes mellitus and systemic disorders had the poorest survival rates; they

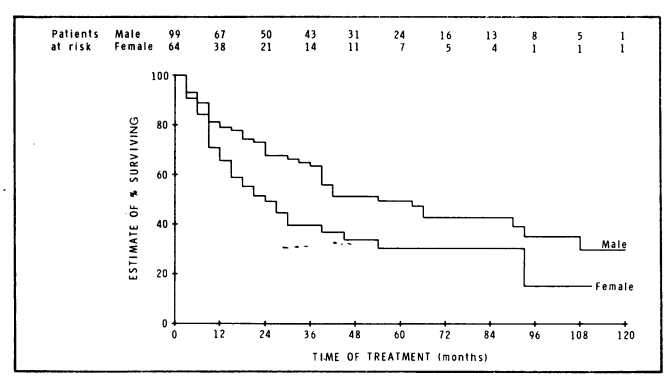

FIG. 3—Life-table estimates of survival according to sex.

were followed by the patients with interstitial renal disease.

Another consideration in interpreting our data is the length of the observation period — 10 years — during which time there have been changes in medical care that may have affected patient survival but might not be part of our treatment stratification. The potential for substantial improvement is apparent in the case of peritoneal dialysis, where the change from intermittent to continuous dialysis produced excellent results.

Considering all these caveats, our results compare well with those published by others. The 8-year survival rate for transplant patients was 70.8% in our series and 63% in that of Price and associates.[3] A 50% survival rate for hemodialysis patients was reached after 3 years and 2 months in our group and after 7 years and 1 month in Price and associates' study population. The latter discrepancy is probably explained by the difference in age distribution in the two studies: 56.5% of our patients, compared with only 16.3% of theirs, were older than 50 years. For patients above the age of 50 years, however, Price and associates reported a much lower 50% survival time — 2 years and 9 months.

We would conclude, therefore, that programs for the treatment of end-stage renal disease can function in regional hospitals and achieve survival results comparable with those of major university centres.

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